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The Walleye in Butternut Lake, Price County, Wisconsin

By: Gerry G. Bever
James M. Lealos

ABSTRACT

The walleye population of Butternut Lake, a 1,006-acre natural lake in northwest Wisconsin, was investigated during 1973. The survey involved spring and fall population estimates, collection of age and growth data and a creel census during the open water angling season. The effects of removing a 13-inch size limit were also investigated. Population estimates for walleyes 9.0 inches and above were 10,441 (10.4/acre) in mid-May and 5,946 (5.9/acre) in early October. Biomass estimates were 6.2 lbs/acre in the spring and 3.9 lbs/acre in the fall. Walleyes attained an average weight of one pound during their fifth summer and averaged 14.2 inches at that weight. Male walleyes reached sexual maturity entering their fourth summer with an average length of 11.0 inches and females entering their fifth summer averaging 12.5 inches. Creel census results revealed an estimated 45.3 hours of angling pressure per acre from May through October. Anglers removed an estimated 3,676 walleyes during this same period for a success rate of .09 walleyes/hr. The total estimated mortality for walleyes 9.0 inches and larger was 4,495 walleyes or 43% of which 35% was angling mortality and 8% was natural mortality. Comparison of this data with past survey data indicates that the absence of a size limit for three angling seasons has had the effect of reducing a 12.9-inch size bottleneck. Greater numbers of large size (13-inch plus) walleyes are now being produced.

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INTRODUCTION

An intensive survey of the game fish population with emphasis on the walleye, Stizostedion vitreum vitreum (Mitchill), was conducted on Butternut Lake, Price and Ashland Counties, Wisconsin, during 1973.

The survey was initiated to gather information concerning the status of several game fish species in the lake. Data regarding walleye sport fishing and harvest, standing crop, biomass, age composition, growth, reproduction and mortality were collected. Insight was also gained into the status of the walleye fishery under recently liberalized regulations (removal of a 13.0-inch size limit in 1971) and the contribution of fall-stocked muskellunge, Esox masquinongy (Mitchill), fingerling to the 1973 year class.

DESCRIPTION OF STUDY AREA

Butternut Lake (Figure 1) is located approximately 3 miles northwest of Park Falls in north central Wisconsin. The total water area is 1,006.2 acres with a 13.5-acre island in the southern part of the lake. There are 11.2 miles of shoreline. Maximum depth is 32 feet with 6.7% under 3 feet and 21% over 20 feet. The water is brown stained with a total alkalinity of 41 ppm and a pH of 7.4. Aquatic plants do not normally present a use problem, but periodic algae blooms occur throughout the open water season. Sand is the predominant littoral bottom type (75%) with 15% rubble, 5% muck, 3% boulder and 2% gravel. The lake has five inlets and one outlet and there are three public access sites available. Although a small number of walleyes do run up the inlet streams to spawn, this is considered insignificant to the total population. For the most part, the lake has a discrete walleye population.

Previous surveys have shown that walleyes are the dominant game fish in Butternut Lake and that the population is maintained by natural reproduction (Bever, 1971). Muskellunge have been stocked annually since 1952 and are presently stocked as large fingerling at the rate of 2 per acre. Other game fish present are northern pike, largemouth bass, smallmouth bass, and lake sturgeon. Other fish species known to occur in Butternut Lake include black crappie, bluegill, yellow perch, pumpkinseed, rock bass, black bullhead, burbot, white sucker, redhorse, common shiner, redbelly dace, and creek chub.

METHODS

Standing crop estimates were made separately for walleye in the spring and fall using Bailey's modification of the Petersen Estimate (Ricker, 1975): $N = M(C+1)/(R+1)$. Estimates were calculated by size group of fish; translations were made to year class by taking a percentage of the estimates by size group. Finclips were used to distinguish captured fish. Sampling gear consisted of fyke nets and boom shocker in the spring and boom shocker alone in the fall. Fyke nets had 5-foot diameter hoops with 1½-2-inch stretch mesh and 50-75-foot leads. Ten nets were fished during the spring marking period from April 19-24, 1973, for a total of 50 net days. This period coincided with the peak of walleye spawning activity. Nets were placed in known spawning areas in an effort to mark as many walleyes as possible.

A 230 volt, 3,000 watt, AC boom shocker was used for nighttime electrofishing. A transformer unit was used during the fall marking and recapture period making possible optimum amperage at all times. Generally, current output varied from 6 to 8 amps. A total of 9 hours and 5 minutes of shocking time was spent during the spring marking period on four separate nights: April 19, 21, 25 and 26. The spring recapture period, utilizing only the boom shocker, consisted of 18 hours and 55 minutes of shocking time on four consecutive nights: May 7-10. The fall marking period, again using only the boom shocker, ran for 4 consecutive nights, October 1-4, for a total of 13 hours and 45 minutes. The fall recapture period encompassed 16 hours of boom shocking in 4 nights, October 22-25.[1]

All game fish captured in the spring and fall were weighed, measured to the nearest one-tenth inch and in the spring, separated by sex. Scale samples were taken from walleyes in the spring and fall, pressed on acetate slides and aged with the use of a projector.

A stratified creel census was conducted from May 12 (opening day of the fishing season) to October 31, 1973. A 12-hour fishing day was assumed and each day was broken down into three 4-hour checking periods: 0800-1200; 1200-1600; and 1600-2000. Five census days were chosen each week: 2 weekend days and 3 randomly selected weekdays. One of the three checking periods was randomly selected for each census day. Angler counts were made at the beginning and end of the checking period and angler interviews were conducted in the interim. A total of 71 days were censused: 32 weekend days and 39 weekdays. Holidays were counted as weekend days.

Total mortality of walleyes over 9.0 inches during the summer was computed by taking the difference between spring and fall standing crop estimates. Angling mortality taken from creel census data was subtracted from the total mortality to arrive at an estimate of natural mortality.

Muskellunge planted prior to the fall estimate were marked by removing the right ventral fin to distinguish them from naturally produced fish and to provide an indication of survival of stocked fingerling.

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[1] It should be noted that the time of year walleyes are sampled introduces a certain amount of bias into the results. Sampling during the spring spawning run produces more males than females, mainly larger mature walleyes and few small (1-3 summer) walleyes. Fall sampling provides an abundance of young-of-the-year walleyes, good numbers of 2-6 summer walleyes and fewer large individuals.

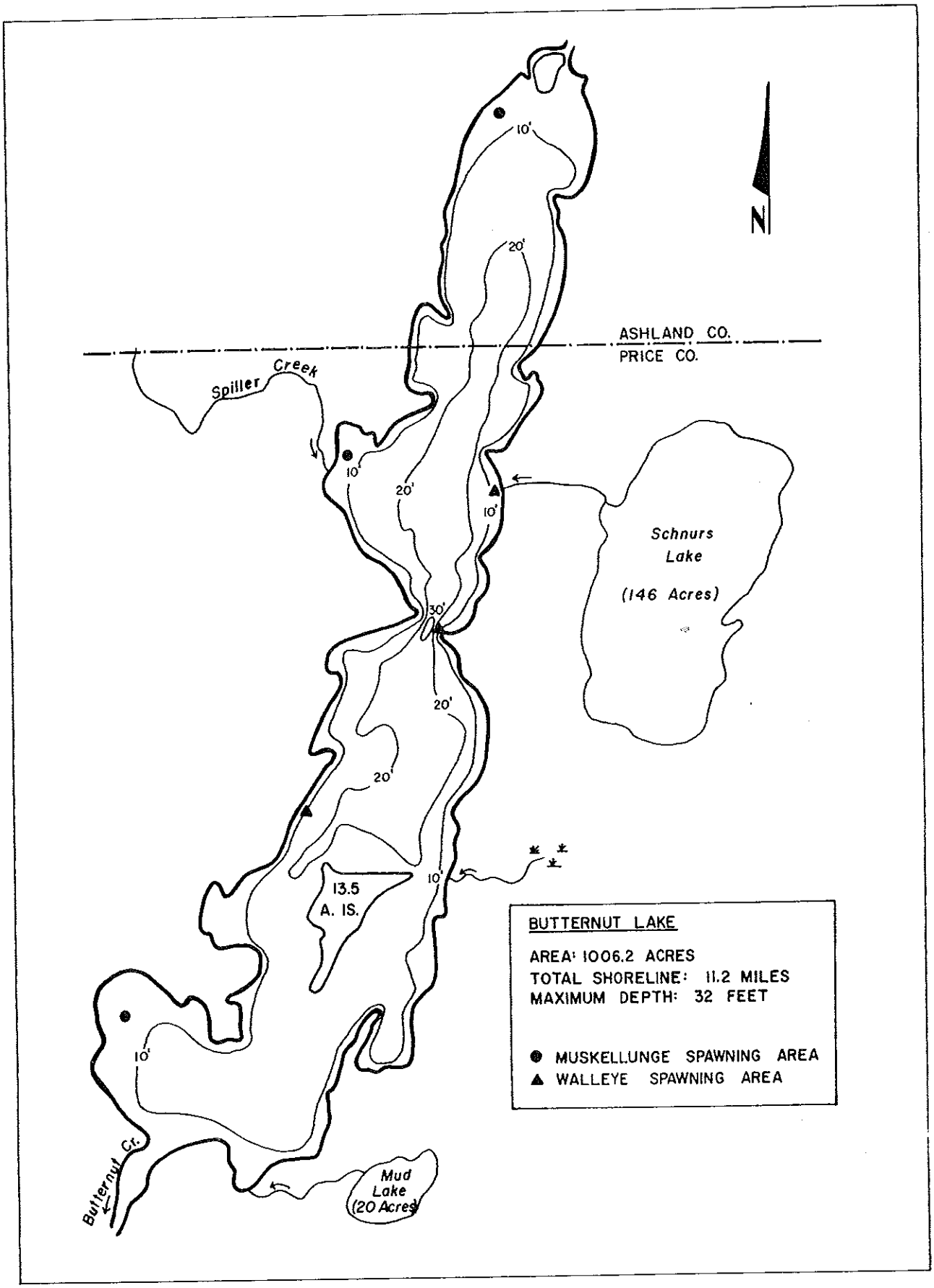

Figure 1. Map of Butternut Lake, Price County, Wisconsin.

RESULTS

Age and Growth

The length frequency of all walleyes captured in both spring and fall surveys is presented in Table 1. Of the 2,961 fish captured in the spring, 74% were less than 13 inches in total length while 89% of the 2,798 fish sampled in the fall were below this size. During the spring survey 1,298 walleyes were sexed (Table 2), of which 1,187 were males and 111 females. A sex ratio of 10.7:1 falls within the extremes of 0.8:1-14:1 reported by Johnson (1971) for walleye spawning populations and is comparable to the 7.6:1 reported by Bever and Lealos (1974) in Pike and Round Lakes, Wisconsin. Sixty-two percent of the males captured were less than 13.0 inches while the females were distributed fairly evenly from 14.0 to 28.0 inches.

Growth rates for Butternut Lake walleyes are presented in Table 3 and compared to rates recorded on Butternut Lake in a 1959 survey. Growth rates are slightly below the average for other lakes in the Park Falls area and fall somewhat behind the 1959 rates.

Growth rates of male and female walleyes are presented in Table 4 and, as expected, females grew at a slightly faster rate. Most females began spawning at the beginning of their 5th summer while males began a year earlier after completing three summers of growth. The youngest mature male walleye recorded was a three-summer fish of 9.7 inches while a four-summer fish of 12.3 inches was the youngest mature female.

Table 1. Length frequency of walleyes captured in Butternut Lake during spring and fall sampling, 1973, by ½-inch size groups.

Total Length (Inches)	Number of Walleyes		Total Length (Inches)	Number of Walleyes	
	Spring	Fall		Spring	Fall
4.5-4.9	2	8	15.5-15.9	70	19
5.0-5.4	13	138	16.0-16.4	40	9
5.5-5.9	23	218	16.5-16.9	35	5
6.0-6.4	29	198	17.0-17.4	16	4
6.5-6.9	15	41	17.5-17.9	9	7
7.0-7.4	30	42	18.0-18.4	11	1
7.5-7.9	91	71	18.5-18.9	3	
8.0-8.4	127	291	19.0-19.4	7	4
8.5-8.9	114	351	19.5-19.9	10	2
9.0-9.4	124	280	20.0-20.4	5	
9.5-9.9	162	126	20.5-20.9	7	2
10.0-10.4	239	142	21.0-21.4	5	1
10.5-10.9	186	111	21.5-21.9	2	2
11.0-11.4	209	155	22.0-22.4	4	
11.5-11.9	277	110	22.5-22.9	5	2
12.0-12.4	330	125	23.0-23.4	2	
12.5-12.9	250	97	23.5-23.9	4	
13.0-13.4	163	80	24.0-24.4	4	2
13.5-13.9	103	58	24.5-24.9	2	
14.0-14.4	78	43	25.0-25.4	3	
14.5-14.9	73	26	25.5-25.9	3	
15.0-15.4	62	27	26.0+	14	
			TOTAL	2,961	2,798

Table 2. Length frequency of spawning walleyes captured in Butternut Lake, spring, 1973.

Total Length (Inches)	Males		Females	
	No. of Fish	% of Total	No. of Fish	% of Total
9.0-9.9	6	.5		
10.0-10.9	78	6.5		
11.0-11.9	284	23.9		
12.0-12.9	366	30.8	2	1.8
13.0-13.9	148	12.5	1	.9
14.0-14.9	114	9.6	6	5.4
15.0-15.9	122	10.3	9	8.1
16.0-16.9	50	4.2	10	9.0
17.0-17.9	9	.8	13	11.7
18.0-18.9	3	.3	8	7.2
19.0-19.9	5	.4	10	9.0
20.0-20.9	1	.1	8	7.2
21.0-21.9	1	.1	5	4.5
22.0-22.9			7	6.3
23.0-23.9			6	5.4
24.0-24.9			6	5.4
25.0-25.9			6	5.4
26.0-26.9			3	2.7
27.0-27.9			3	2.7
28.0-28.9			7	6.3
29.0-29.9			1	.9
Total Sample Size	1,187		111	

Table 3. Growth rate of Butternut Lake walleyes sampled in spring and fall 1973 and compared to rates recorded in 1959.

Completed Summers of Growth*	Avg. Length (Inches) for NW Wis.+	1973			1959		
		Avg. Length (Inches)	Size Range (Inches)	Sample Size	Avg. Length (Inches)	Size Range (Inches)	Sample Size
1	5.7	5.8	4.6-7.0	100	4.3	3.9-5.0	6
2	9.5	7.8	5.4-8.6	170	7.2	6.1-8.4	14
3	12.3	10.0	8.4-11.6	270	9.0	8.7-12.2	19
4	14.6	12.1	8.7-13.8	405	13.2	12.3-16.1	14
5	16.6	14.2	11.6-16.6	262	15.6	13.7-17.8	13
6	18.6	16.4	14.0-18.6	105	17.6	16.9-18.2	2
7		18.3	16.1-19.8	25	21.3	21.2-21.3	2
8		19.3	18.0-20.0	12			
9		21.3	19.9-23.9	26			
10		22.8	19.4-24.0	12			
11		24.8	24.0-25.6	9			

*In lumping spring and fall sampled walleyes in the same completed summer category, it is assumed that over-winter growth of the spring sampled walleyes is negligible.

+Wisconsin D.N.R. Research Report No. 46. Average of 3 Northwest Wisconsin drainage lakes.

Table 4. Differential growth by sex of Butternut Lake walleyes, spring, 1973.

Completed Summers of Growth	Male			Female		
	No. Fish Aged	Avg. Length (Inches)	Percent Sample	No. Fish Aged	Avg. Length (Inches)	Percent Sample
3	52	11.0	9.9			
4	254	12.3	48.4	2	12.5	1.9
5	162	14.5	30.9	13	15.1	12.2
6	47	16.3	9.0	26	17.2	24.3
7	5	18.1	1.0	11	18.9	10.3
8	2	19.4	.4	6	19.5	5.6
9	1	20.6	.2	16	21.6	15.0
10	2	20.2	.4	7	23.3	6.5
11				8	24.8	7.5
12				9	26.4	8.4
13				8	28.2	7.5
14				1	29.3	.9
TOTAL	525			107		

Standing Crop and Biomass

Based on estimates divided into four length categories (Table 5) the spring population of walleyes 9.0 inches and larger was 10,441 or 10.4 per acre. Fall estimates in the same manner yielded a population estimate of 5,946 or 5.9 per acre, a decrease of 4,495 walleyes or 43%. Seventy-five percent of the walleyes in the spring estimate were between 9.0 and 12.9 inches and 77% were in this same size group in the fall.

Population estimates by year class (Table 6) reveal a 60% loss of age III and older walleyes from spring to fall. This mortality estimate would appear to be the more accurate of the two, since it deals with the same fish from spring to fall. The estimate arrived at by size group (43%) does not consider the recruitment of fish in the 9.0" and over sizes. The greatest percent loss was found in the 1969 and 1968 year classes, each exhibiting a 78% decrease from spring to fall. This corresponds with the harvest data, which indicate the bulk of the catch was from these year classes.

Production of fingerling walleyes estimated for 1973 was 2,220 or 2.2 per acre. No special effort was expended or needed in sampling the fingerling walleyes. Approximately 20% of the total number of walleyes sampled in the fall were young-of-the-year. A spring, 1973, estimate of the 1972 production was not obtained since too few recaptures were collected.[2]

Average weight at each completed summer of growth is presented in Table 7. Weight triples during the second summer and nearly doubles each succeeding summer for the next three years. Walleyes did not begin reaching one pound until late in their 5th summer. Total biomass of walleyes 9.0 inches and over decreased from 6.2 to 3.9 lbs/acre or 37% from spring to fall.

Angling Pressure and Exploitation

During the course of the summer-long creel census, 1,451 anglers were interviewed, harvesting a total of 256 walleyes (Table 8). Anglers logged an estimated 32,386 hours of boat angling pressure and 12,944 hours of shore angling pressure from May through October. This yielded a total estimated angling pressure of 45.3 hours/acre. The harvest was heaviest in May and June with 50% and 23% of the total harvest taken respectively in these two months. July was the poorest angling month with only 2% of the harvest.

The estimated harvest of walleyes 9.0 inches and over was 3,632 (3.6/acre) (Table 9). The average catch rate of .09 walleyes/hour (Table 8) is an extreme minimum since the angling pressure represents the summation of the total hours fished for all species rather than for walleyes alone. Total mortality of walleyes 9.0 inches and greater was 43%. The exploitation rate from opening day through October was 35% leaving a natural mortality of 8%.

[2]This and past studies have demonstrated that due to water temperature, sexual maturity and other factors, the 1-summer segment of the walleye population is not present in large enough numbers during the spawning run to allow adequate sampling with our present technique.

Table 5. Population estimates of Butternut Lake walleyes over 9.0 inches total length, 1973.

Total Length (Inches)	Spring		Fall	
	Number	95% C. L.	Number	95% C. L.
9.0-10.9	3,820	2,980-5,960	2,233	1,794-3,389
11.0-12.9	4,028	3,102-5,480	2,357	1,833-3,929
13.0-14.9	1,679	1,131-3,286	680	460-1,227
15.0 or larger	914	609-1,610	676	289-5,200
Total	10,441		5,946	

Table 6. Population estimates of Butternut Lake walleyes by cohort.

Year Class	Population Estimate		Percent Loss
	Spring	Fall	
1973	--	2,220	--
1972	*	3,110	--
1971	2,416	2,562	-6%
1970	4,048	2,649	35%
1969	4,092	905	78%
1968	1,752	388	78%
1967	303	138	54%
1966	64	47	27%
1965 & older	265	123	54%
Total (1970 & older)	10,524	4,250	59.6%

*Too few recaptures were sampled in the spring to provide an accurate estimate of one-summer walleyes.

Table 7. Weight of Butternut Lake walleyes measured in the fall, 1973.

Completed Summers of Growth	Average Weight (lbs)	Weight Range (lbs)	Sample Size
1	.05	.03-.09	53
2	.15	.04-.23	97
3	.27	.14-.44	91
4	.50	.20-.88	100
5	.86	.45-1.50	58
6	1.40	1.00-2.00	26
7	2.01	1.44-2.75	9
8	2.59	2.19-2.88	3
9	3.32	3.12-3.63	5
10	5.0		1
11	4.56		1
13	8.06		1

Table 8. Catch rates for walleyes caught in Butternut Lake, May-October, 1973. Rates reflect time spent fishing for all species and, as such, are minimum rates.

Months	Number Anglers	Total Hours Fished	Number Walleyes Caught	Number Walleye/ Angler	Number Walleye/ Hour
May	321	824.25	128	.399	.155
June	255	495.00	58	.227	.117
July	244	328.25	6	.025	.018
August	278	476.75	22	.079	.046
September	251	582.25	20	.080	.034
October	102	204.75	22	.216	.107
TOTAL	1,451	2,910.75	256	.176 (avg.)	.088 (avg.)

Table 9. Actual and projected harvest of walleyes from Butternut Lake, May-October, 1973.

Size Range (Inches)	Actual Number of Walleyes Taken							Est. Number Harvested
	May	June	July	August	September	October	Total	
7.0 - 8.9	1	1			1		3	44
9.0 - 10.9	21	6		4	1	3	35	526
11.0 - 12.9	57	29	2	13	7	11	119	1,787
13.0 - 14.9	25	17	2	4	5	8	61	915
15.0 or larger	13	5		2	6	1	27	404
TOTAL	117	58	4	23	20	23	245*	3,676
					Total 9.0" and over. . .			.3,632

*256 walleyes were recorded by the creel clerks, but 11 of these were not measured.

The average size of walleyes harvested by anglers was 12.6 inches with nearly 49% between 11.0 and 12.9 inches in total length. Approximately 64% of the walleye harvest fell below the former 13-inch size limit. Anglers accepted walleyes down to 8.5 inches although only 1% of the harvest was under 9.0 inches (Table 9). The 1969 year class (fish in their 5th summer) comprised 50% of the harvest. Ninety-one percent of the total harvest was absorbed by three year classes: 1968, 1969 and 1970 (walleyes in their 6th, 5th, and 4th summers of growth respectively).

Other Game Fish Species

Population estimates for muskellunge were conducted concurrently with those for walleye. Too few recaptures were taken to allow valid estimates of muskellunge under 16.5 inches in either the spring or fall. Standing crop estimates of muskellunge 16.5 inches and larger were 513 and 491 in the spring and fall respectively. Estimated numbers of legal muskellunge (30 inches or larger) were 185 (.18/acre) in the spring and 73 (.07/acre) in the fall.

Eight hundred muskellunge fingerling were planted in Butternut Lake on September 26, 1973. During the fall marking period (October 1-4), 42 of the stocked fingerling were recovered ranging in size from 10.5 to 13.9 inches. The fall recapture period (October 22-25) turned up 46 of the stocked fingerling. Only seven native muskellunge young-of-the-year were captured in the two fall sampling periods. These ranged in size from 8.0 to 11.9 inches which is considerably smaller than the stocked fingerling. This indicates that survival of stocked muskellunge was good at least one month after stocking and that stocked fish may be contributing significantly to year class strength.

Muskellunge catch records at a local resort have been kept since 1963 (Table 10). The average size of the recorded muskellunge has stabilized at about 35.5 inches. Although muskellunge data was sought in the creel census, it was virtually impossible to monitor angler success rates. This was due mainly to the fact that once the bag limit was obtained by a muskellunge angler, he did not continue to fish. The creel clerk literally had to be present when the fish was caught to gather any information. The only exception was when an angler caught a muskellunge incidental to his walleye or northern angling. However, this latter case was the rare exception since the majority of the muskellunge harvested were caught by muskellunge-only anglers.

Other gamefish species sampled during the survey were northern pike, largemouth bass and smallmouth bass (Table 11). Northern pike sampled were all under 30 inches in total length and their number are apparently on the increase in view of past survey information. Largemouth bass and smallmouth bass were present only as remnant populations, their numbers contributing very little to the total fishery. Since the scope of this project did not include an analysis of the panfishery, no information is presented on these species, other than to mention their presence in the description section.

DISCUSSION

Population Levels

Butternut Lake has a fish species composition similar to most walleye lakes in this area of Wisconsin: the dominant walleye population is relatively slow-growing and appears to be controlling other fish species in the lake and the majority of the walleyes are less than 13 inches in length. The panfish population, although not dealt with in this paper, is not extensive and appears to fluctuate as does the walleye population. Other fish species considered as forage also appear to fluctuate and are relatively few in number.

Table 10. Muskellunge harvest recorded at Northern Pines Resort on Butternut Lake.

Size Range (Inches)	Year				
	1963	1964	1972	1973	1975
30 - 34.9	14	15	35	33	26
35 - 39.9	12	18	7	11	22
40 - 44.9	4	13	15	6	7
45 - 49.9	1	7	1	5	2
50 - 54.9			1		
TOTAL	31	53	59	55	57
Avg. Size	35.7"	38.2"	35.6"	35.4"	35.7"

Table 11. Actual numbers of various game fish species captured during sampling in spring and fall, 1973.

Size Range (Inches)	Muskellunge	Northern Pike	Largemouth Bass	Smallmouth Bass
0 - 4.9			5	
5.0 - 9.9	3	2	1	5
10.0 - 14.9	114	19	2	
15.0 - 19.9	97	25	10	
20.0 - 24.9	70	42	1	
25.0 - 29.9	43	12		
30.0 - 34.9	41			
35.0 - 39.9	16			
40.0 - 44.9	10			
45.0 and over	7			
TOTAL	401	100	19	5

The standing crop estimates for walleyes 9.0 inches and over were 10,441 or 10.4/acre in the spring and 5,946 or 5.9/acre in the fall. Biomass levels dropped from 6.2 pounds/acre in the spring to 3.9 pounds/acre in the fall. Comparisons with other midwest walleye lakes indicate the Butternut Lake walleye population to be about average. Olson (1958) in Many Point Lake, Minnesota, found 7-11 walleyes/acre age III and above. Forney (1967) in Oneida Lake, New York, found 5-20 walleyes/acre age IV and over. Escanaba Lake, Wisconsin, produced 5-23 walleyes/acre age III and above over a 24-year period (Kempinger, 1975). Pike and Round Lakes, Wisconsin, had 11.1 walleyes/acre and 4.1 walleyes/acre 9.0 inches and larger in the spring and fall respectively (Bever and Lealos, 1974).

Walleye fingerling production was quite low (2.2/acre) when compared to other lakes supporting good walleye populations. Kempinger (1975) found an average of 41 fingerling/acre and a range of nearly 0 to 108/acre in Escanaba Lake. He did note that the smallest adult population (5/acre) in the 24-year study period produced the largest fingerling year class (108/acre). The comparatively small 1973 year class follows 3 good years of walleye production. The 1972, 1971, and 1970 year classes all had more fish remaining after 1½, 2½, and 3½ years of mortality, respectively, an indication of the year class fluctuation that occurs in Butternut Lake.

During both the marking and recapture periods of the fall estimate, stocked muskellunge accounted for most of the one-summer fingerling captured (91 and 94% respectively). Standing crop of muskellunge over 16.5 inches was 513 (.51/acre) in the spring and 491 (.49/acre) in the fall. The standing crop of legal size muskellunge was 0.18/acre in the spring and 0.07/acre in the fall. This density has succeeded in establishing Butternut Lake as one of the area's best muskellunge producers. There is little data in the literature with which to compare muskellunge densities although most information suggests a rather low standing crop of legal size fish, in even the best of lakes.

Angling Pressure and Harvest

The exploitation rate of .35 for Butternut Lake walleyes 9.0 inches and larger is comparable to other midwestern lakes. Kempinger (1975) reported a range of .13 to .42 and an average of .29 over a fourteen-year period on Escanaba Lake. Mraz (1968) in his Pike Lake, Wisconsin, study noted an average exploitation rate of .22 for 10-inch and larger walleyes. In Oneida Lake, New York, Forney (1967) reported a range of .10 to .47 and an average of .24 for walleyes age IV and older.

The 1973 walleye harvest in Butternut Lake was generally lower than other midwestern lakes: 3.6 walleye per acre and 1.9 pounds per acre. Kempinger (1975) recorded an average annual harvest of 10 walleyes per acre and 8 pounds per acre. The average size of walleyes harvested from Butternut Lake was 12.6 inches and 0.52 pounds which is fairly close to Kempinger's 17-year average of 12.9 inches. The catch rate of .09 walleyes/hour was also low compared to other walleye lakes. Olson (1958) reported a range of .11 to .16 walleye per hour. Kempinger (1975) noted a range of .04 to .34 walleye per hour harvested from Escanaba Lake from 1946 to 1969.

Effects of Liberalized Size Limit

A 13-inch minimum size limit on walleyes was in effect on Butternut Lake for many years prior to its removal in 1971. Data on relative abundance gathered during this time indicate several undesirable situations had occurred (Figure 2). First, production of larger (>16.0") walleyes was low. Secondly, that portion of the walleye population below the 13-inch limit was exceedingly large and exhibited slow growth. In effect, a size bottleneck at 13 inches had resulted. Growth improved somewhat as walleyes attained larger sizes. Competition from the large population of sublegal walleyes undoubtedly played an important role in depressing these growth rates. Protection of spawning females, whether needed or not, was not accomplished by a 13-inch size limit, since in fact, fishing pressure on mature females was greater with the size limit than without it.

The effects of the liberalized size limit on the walleye population cannot be directly identified here, since adequate population, harvest and growth data for the period when the size limit was in effect are lacking. Also, it may be premature to judge the liberalized size limit after being in effect for only two years.

Several noteworthy trends have become apparent, however, in this two-year period. That portion of the population from 9.0 to 12.9 inches appears to have been reduced and those walleyes over 13 inches have increased in number. The liberalized size regulation has resulted in an increase in walleye harvest opportunity. Catch data reveal that 64% of the walleyes taken in 1973 were below 13 inches. With the availability of the entire population to angling, creel census results indicate that a year class enters the fishery in its third summer at about 9 inches.

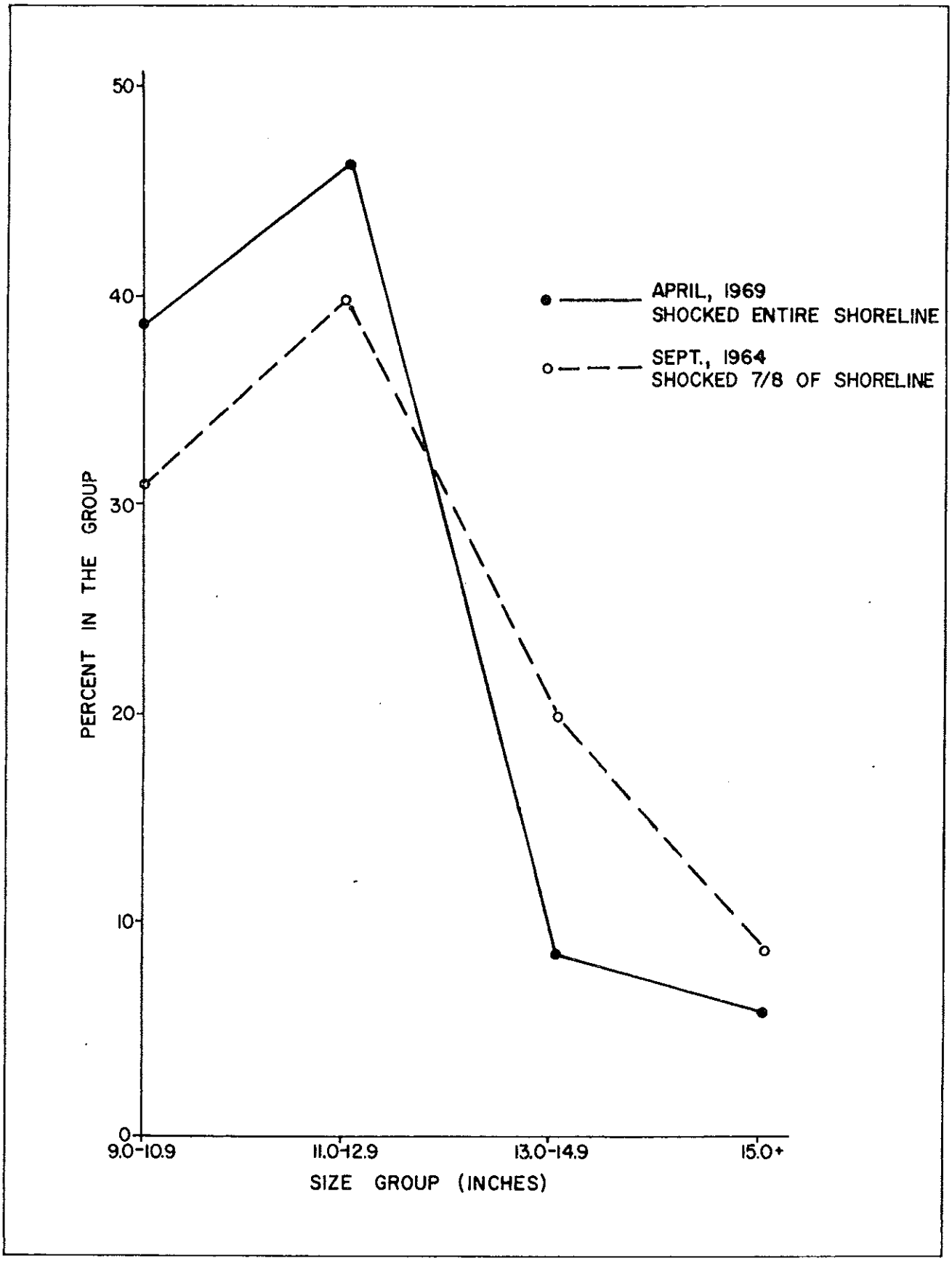

Figure 2. Percent of various size groups of walleyes sampled in Butternut Lake in 1964 and 1969.

MANAGEMENT IMPLICATIONS

In general, a lake has the capacity to produce only a finite biomass of fish flesh per unit volume in a given time span. This holds true for individual species as well. In the case of walleyes, this biomass can be made up of large numbers of small fish, smaller numbers of large fish or some desirable balance in between. It is generally this "desirable balance" that is sought in attempting to manage walleye populations at an optimum level. It has been demonstrated that angler harvest is the major portion of the total annual mortality of walleyes. Directing this harvest to walleyes over 13 inches has not resulted in a desirable balance in the population. Instead, large numbers of small walleyes have resulted. Results from this survey on Butternut Lake after two seasons with a liberalized size limit and from surveys of similar lakes in this area with a longer history of liberalized size limits indicate that this imbalance can be corrected or at least modified. Larger numbers of walleyes over 13 inches are produced under these conditions while at the same time anglers are exploiting the formerly sublegal segment of the population to a large degree. Although this may not be a panacea in the management of walleyes, the liberalization of size limits certainly appears to be producing desirable results.

Survey results have indicated that stocked muskellunge play a major role in maintaining the muskellunge population in Butternut Lake. Future shoreline encroachment and habitat destruction can be expected to continually downgrade the role of naturally produced muskellunge in maintaining this population.

Butternut Lake will continue under a liberalized "no minimum length" size regulation and will continue to receive an annual quota of planted muskellunge fingerling. All stocked fish will receive a distinguishing finclip for future identification. A follow-up survey of basically this same magnitude will be conducted in several years to monitor developments in the fishery.

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